



# Exploitation of microbial consortia and mixed cultures with microalgal species for the treatment of bioplastics

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## **Bioplastics**

According to the provisions in GB/T 39514-2020, bioplastics are bio-synthetic plastics derived from biomass, and plastics obtained from renewable materials as initial raw materials.

Bioplastics are generally classified into three main categories (European Bioplastics, 2018):

- 1. bio-based but non-compostable plastics
- 2. bio-based and degradable plastics (i.e. TPS, PHAs)
- 3. biodegradable fossil resource plastics

#### Therefore, a bioplastic is the plastic that is either bio-based, biodegradable or both





European Bioplastics, 2020

**Bioplastics** 

Minimum or a negative impact on carbon emissions



Discharge and Persistence in the environment

 biodegradation may only occur when the surrounding environment fulfils the requirements of biodegradability

• Micro/nanoplastic generation



microbiota algae small crustacean mollusca fish



- Low degradation rates
- Sorption of organic contaminants
- Numerous additives

Effects induced by bioplastics are similar to those of conventional plastics



As production of bioplastics is increasing, it is likely that their contribution to plastic waste will increase and become comparable to that of the conventional plastics so it is of outmost importance to develop appropriate end-of-life management schemes.

zero-waste-focused circular economy

The aim of this study was to investigate the potential of microbiomes as candidates for **bio-recycling** of the most popular biopolymers

- Thermoplastic starch (TPS)
- Poly(3-hydroxybutyrate) (PHB)
- polylactic acid (PLA)
- bio-based poly(ethylene) (BioPE) pretreated



## Biofilm of bioplastics exposed to agricultural soils/ activated sludge + Microalgae (*Chlorella* sp)





DAY





Microbiome on the surface of the pellets



8











- *Chlorella* sp. can grow in the presence of all bioplastics besides weathered PLA
- The presence of acclimated microbial consortia have a positive impact on the growth of microalgae in the presence of bioplastics
- Weight reduction is high when bioplastics are incubated with mixed cultures
- Production of high added value products from microalgae (lipids, pigments, proteins)

Mixed cultures of microbes and microalgae are a promising sustainable EoL of waste bioplastics meeting the goals of circular economy

## Thank you very much for your attention !!!!